Tree Species Detection on Satellite Imagery Data

Authors: Cyndi Chen, Kenny Wu, Yunshu Cai, Yunze Pan, Ziyan Liu
Industry Mentors: Harini Srinivasan, Gurkanwar Singh
Faculty Mentors: Sining Chen, Aayush Verma

Background and Overview

Tree species information is important in several industrial applications, including tracking invasive species, understanding trees growth rate to plan trimming, and removing unhealthy trees by utility companies and railways, etc.

Our project aims to use remote-sensing satellite images and labeled tree species data with geo-locations to identify tree species. We used multiple ML algorithms, including deep learning techniques to build multiple tree species detection models.

Data Analysis and Preparation

We visualized the satellite imagery in QGIS and processed it using Python.
- We firstly associated all the pixels with identified species.
- The core features for each pixel are the four bands (R,G,B,NIR) values, and we also calculated some aggregated features (Max, Standard deviation, Texture features).
- We finally produced input data that was pixel-based.
- We also created tile-based input data using Python, where each tile is 8x8 pixels.

Results and Conclusion

While some models show promising results, some others still need to be fine tuned.
- With total 18 features (R, G, B, NIR, NDVI, and aggregated features), Random Forest is the best performing model with 67% test accuracy.
- With the basic 4 bands features, ResNet20 is the best model with 58% test accuracy.
- With more complex CNN-based model (U-Net), our classification accuracy could be improved.

Acknowledgments

We thank Harini Srinivasan and Gurkanwar Singh for guiding us throughout the project and providing feedback and suggestions on our paper.

References

Deur, M., Gašparović, M., & Balenović, I. - Tree species classification in mixed deciduous forests using very high spatial resolution satellite imagery and machine learning methods.